Young's modulus, a bulk modulus and a Poisson's ratio associated with the target site;

a second [probe mechanism] sensor that measures one or more thermal parameters, drawn from a group consisting of local temperature, thermal conductivity and specific heat capacity associated with the target site;

a third [probe mechanism] sensor that measures optical reflectance OR(λ;meas) of a selected region of the target site for one or more selected wavelength ranges;

a fourth [probe mechanism] sensor that measures a selected characteristic of a margin of the target site;

an fifth [probe mechanism] sensor that measures amount of blood flow adjacent to or within the target site;

a sixth [probe mechanism] sensor that measures interstitial fluid pressure adjacent to or within the target site;

a seventh [probe mechanism] sensor that measures vascular size and/or vascular density associated with the target site;

an eighth [probe mechanism] sensor that measures oxygen tension pO2 associated with the target site;

a ninth [probe mechanism] sensor that measures local pH associated with a selected portion of the target site; and

a tenth [probe mechanism] sensor that measures at least one of an electrical parameter associated with a selected portion of the target site [;and].

*2 (amended). The system of claim 1, wherein [said] at least one [probe] of said two sensor measurements is combined with at least one additional measurement that is drawn from a group of measurements, performed adjacent to or within said target site, consisting of lymph node samples, mammograms, ultrasound scans, NMRI scans, CAT scans, estimation of target site size, estimation of target site shape, estimation of target site surface roughness and estimation of calcification pattern.

*3 (amended). The system of claim 1, wherein at least one [probe] of said two sensor measurements is [combines] combined with at least one additional information item that is drawn from a group consisting of (1) at least one medical condition that said animal has exhibited and (2) at least one medical condition that a family member of said animal has exhibited.

*4 (amended). The system of claim [1] 19, wherein, when [each of] at least one [two] of said [probe mechanisms] sensors provides a measurement value that does not fall within said corresponding range of values for said normal target site, said database and analyzer provides at least one disease or malady of said target site that is consistent with each of [the] said [at least two probe mechanism] sensor measurement[s].

*5 (amended). The system of claim [1] 19, wherein said analyzer comprises a neural net device that receives and processes said measurement from said at least [one probe mechanism] two sensors and provides [a] at least one processed measurement value that can be compared with said corresponding range of values for said normal target site.

6. The system of claim 5, wherein said neural net device performs a radial basis neural network analysis.

7. The system of claim 5, wherein said neural net device performs a backpropagation neural network analysis.

*8 (amended). The system of claim 1, wherein at least one of said [probe mechanisms] two sensors is used to navigate said probe to a location adjacent to or within said target site.

*9 (amended). A method for performing one or more relevant measurements at a target site in an animal body, the method comprising:

providing a probe that can be inserted into a body adjacent to or within a target site and that comprises at least [one] two of:

a first [probe mechanism] sensor that measures one or more elastic parameters associated with the target site drawn from a group consisting of a Young's modulus, a bulk modulus and a Poisson's ratio associated with the target site;

a second [probe mechanism] sensor that measures one or more thermal parameters, drawn from a group consisting of local temperature, thermal conductivity and specific heat capacity associated with the target site;

a third [probe mechanism] sensor that measures optical reflectance OR(λ;meas) of a selected region of the target site for one or more selected wavelength ranges;

a fourth [probe mechanism] sensor that measures a selected characteristic of a margin of the target site;

an fifth [probe mechanism] sensor that measures amount of blood flow adjacent to or within the target site;

a sixth [probe mechanism] sensor that measures interstitial fluid pressure adjacent to or within the target site;

a seventh [probe mechanism] sensor that measures vascular size and/or vascular density associated with the target site;

an eighth [probe mechanism] sensor that measures oxygen tension pO2 associated with the target site;

a ninth [probe mechanism] sensor that measures local pH associated with a selected portion of the target site; and

a tenth [probe mechanism] sensor that measures at least one of an electrical parameter associated with a selected portion of the target site [;and] .

[providing a database and analyzer, including a computer that is programmed to receive and compare each measurement made by the probe with a corresponding

range of values that is representative of a normal target site and, for each probe measurement that does not fall within the corresponding range of values for a normal target site, the database and analyzer provides at least one disease or malady of the target site that is consistent with the probe measurement.]

*10 (amended). The method of claim 9, further comprising combining said at least one of said [probe] two sensor measurements with at least one additional measurement, performed adjacent to or within said target site, consisting of lymph node samples, mammograms, ultrasound scans, NMRI scans, CAT scans, estimation of target site size, estimation of target site shape, estimation of target site surface roughness and estimation of calcification pattern.

*11 (amended). The method of claim 9, further comprising combining at least one of said [probe] two sensor measurements with at least one additional information item that is drawn from a group consisting of (1) at least one medical condition that said animal has exhibited and (2) at least one medical condition that a family member of said animal has exhibited.

*12 (amended). The method of claim [9] 18, further comprising:

when each of at least [two] one of said [probe mechanisms] sensors provides a measurement value that does not fall within said corresponding range of values for said normal target site, said computer is programmed to provide at least one disease or malady of said target site that is consistent with each of the at least two [probe mechanism] sensor measurement[s].

*13 (amended). The method of claim [9] 18, further comprising providing said analyzer with a neural net device that receives and processes said measurement from said at least one [probe mechanism] sensor and provides a processed measurement value that can be compared with said corresponding range of values for said normal target site.

14. The method of claim 13, further comprising choosing said neural net device to perform a radial basis neural network analysis.

15. The method of claim 13, further comprising choosing said neural net device to perform a backpropagation neural network analysis.

*16 (amended). The method of claim 9, further comprising using at least one of said [probe mechanisms] sensors to navigate said probe to a location adjacent to or within said target site.

*17 (new). The system of claim 1, wherein at least one of said at least two sensors is said third sensor that measures said optical reflectance, using at least one optical fiber that transports an image of a selected portion of said selected region of said target site.

*18 (new). The method of claim 9, further comprising providing, as at least one of said at least two sensors, said third sensor and measuring said optical reflectance by using at least one optical fiber that transports an image of a selected portion of said selected region of said target site.

*19 (new). The system of claim 1, further comprising a database and analyzer that receives and compares each of said measurements made by said probe with a corresponding range of values that is representative of a normal target site and, for each of said sensor measurements that does not fall within the corresponding range of values for a normal target site, the database and analyzer provides at least one medical condition of said target site that is generally consistent with said sensor measurement.

*20 (new). The method of claim 9, further comprising providing a database and analyzer, including a computer that is programmed to receive and compare each of said measurements made by said probe with a corresponding range of values that is representative of a normal target site and, for each of said probe measurements that does not fall within the corresponding range of values for a normal target site, the database and analyzer provides at least one disease or malady of the target site that is consistent with said probe measurement.

*21 (new). A system for estimating a medical condition associated with a target site in an animal body, the system comprising:

a first database that contains R-dimensional vector values $\mathbf{x}(q)$ of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value $\mathbf{x}(q)$ in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

a second database that contains vector values $\mathbf{y}$ in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where $\mathbf{y}$ is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

a computer that is programmed to form a non-negative, real-valued medical condition function of a metric distance between the vector $\mathbf{x}(q)$ and the vector $\mathbf{y}$, where the medical condition function distinguishes between a first medical condition in which $\mathbf{y}$ is more likely associated with the first set S1 and a second medical condition in which $\mathbf{y}$ is more likely associated with the second set S2.

*22 (new). The system of claim 21, wherein at least one of said sets S1 and S2 corresponds to at least one of a normal medical condition and a benign medical condition.

*23 (new). The system of claim 21, wherein at least one of said sets S1 and S2 corresponds to a malignant medical condition.

*24 (new). A system for estimating a medical condition associated with a target site in an animal body, the system comprising:

a first database that contains R-dimensional vector values x(q) of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value x(q) in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

a second database that contains vector values y in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where y is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

a computer that is programmed:

to form a non-negative, real-valued metric d(x(q);y;q), depending upon vectors x(q) and y drawn from the first and second databases, respectively, and upon the index q;

to form a medical condition function F(d(x(q);y;q)), depending upon the metric values d(x(q);y;q), where F is a selected non-negative, monotonically decreasing function of the metric value d(x(q);y;q);

to compute the quantities $F1(y) = \max_{w(q) \text{ in } S1} F(d(w(q);y;q))$ and $F2(y) = \max_{w(q) \text{ in } S2} F(d(w(q);y;q))$;

when F1(y) > F2(y), to interpret the value F1(y)/{F1(y)+F2(y)} as a lower bound on a probability that the measurement value y is associated with the first set S1, and to interpret the value F2(y)/{F1(y)+F2(y)} as an upper bound on a probability that the measurement value y is associated with the first set S2; and

when F1(y) < F2(y), to interpret the value F1(y)/{F1(y)+F2(y)} as an upper bound on a probability that the measurement value y is associated with the

first set S1, and to interpret the value F2(y)/{F1(y)+F2(y)} as a lower bound on a probability that the measurement value y is associated with the first set S2.

*25 (new). The system of claim 24, wherein said computer is further programmed to draw said function F(z) for a non-negative value z from a group of functions consisting of $F(z) = \exp\{-\alpha \cdot z^P\}$, $F(z) = \{\beta + \chi \cdot z^r\}^{-\gamma}$ and $F(z) = \mu - \nu \cdot z^s$, where α, β, χ, γ, μ, ν, p, r and s are selected non-negative values.

*26 (new). The system of claim 24, wherein said metric d(x(q);y;q) depends upon said vectors x(q) and y and depends upon said index q only through said vector x(q).

*27 (new). The system of claim 24, wherein, for at least two distinct values q' and q" with corresponding vectors x(q') in said set S1 and x(q") in said set S2, said metric value d(x(q');y;q') differs from said metric value d(x(q");y;q") for at least one measurement vector y.

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*28 (new). The system of claim 24, wherein each of said functions F(d(x(q);y;q)) is chosen to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and said computer is further programmed to interpret said value F(d(x'(q);y;q)) for at least one vector x'(q) in said set S1 as a probability that said measurement vector y belongs to said set S1.

*29 (new). The system of claim 24, wherein each of said functions F(d(x(q);y;q)) is chosen to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and said computer is further programmed to interpret said value F(d(x'(q);y;q)) for at least one vector x'(q) in said set S2 as a probability that said measurement vector y belongs to said set S2.

*30 (new). The system of claim 24, wherein at least one of said sets S1 and S2 corresponds to at least one of a normal medical condition and a benign medical condition.

*31 (new). The system of claim 24, wherein said at least one of said sets S1 and S2 corresponds to a malignant medical condition.

*32 (new). A method for estimating a medical condition associated with a target site in an animal body, the method comprising:

providing a first database that contains R-dimensional vector values $\mathbf{x}(q)$ of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value $\mathbf{x}(q)$ in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

providing a second database that contains vector values $\mathbf{y}$ in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where $\mathbf{y}$ is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

programming a computer to form a non-negative, real-valued medical condition function of a metric distance between the vector $\mathbf{x}(q)$ and the vector $\mathbf{y}$, where the medical condition function distinguishes between a first medical condition in which $\mathbf{y}$ is more likely in the first set S1 and a second medical condition in which $\mathbf{y}$ is more likely in the second set S2.

*33 (new). The method of claim 32, further comprising choosing said at least one of said sets S1 and S2 to correspond to at least one of a normal medical condition and a benign medical condition.

*34 (new). The method of claim 32, further comprising choosing at least one of said sets S1 and S2 to correspond to a malignant medical condition.

*35 (new). A method for estimating a medical condition associated with a target site in an animal body, the method comprising:

providing a first database that contains R-dimensional vector values $\mathbf{x}(q)$ of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value $\mathbf{x}(q)$ in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

providing a second database that contains vector values y in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where y is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

programming a computer:

to form a non-negative, real-valued metric $d(\mathbf{x}(q);y;q)$, depending upon vectors $\mathbf{x}(q)$ and y drawn from the first and second databases, respectively, and upon the index q;

to form a medical condition function $F(d(\mathbf{x}(q);y;q))$, depending upon the metric values $d(\mathbf{x}(q);y;q)$, where F is a selected non-negative, monotonically decreasing function of the metric value $d(\mathbf{x}(q);y;q)$;

to compute the quantities $F1(y) = \max_{w(q) \text{ in } S1} F(d(w(q);y;q))$ and $F2(y) = \max_{w(q) \text{ in } S2} F(d(w(q);y;q))$;

when $F1(y) > F2(y)$, to interpret the value $F1(y)/\{F1(y)+F2(y)\}$ as a lower bound on a probability that the measurement value y is associated with the first set S1, and to interpret the value $F2(y)/\{F1(y)+F2(y)\}$ as an upper bound on a probability that the measurement value y is associated with the first set S2; and

when $F1(y) < F2(y)$, to interpret the value $F1(y)/\{F1(y)+F2(y)\}$ as an upper bound on a probability that the measurement value y is associated with the first set S1, and to interpret the value $F2(y)/\{F1(y)+F2(y)\}$ as a lower bound on a probability that the measurement value y is associated with the first set S2.

*36 (new). The method of claim 35, further comprising programming said computer to draw said function F(z) for $z \geq 0$ from a group of functions consisting of $F(z) = \exp\{-\alpha \cdot z^p\}$, $F(z) = \{\beta + \chi \cdot z^r\}^{-\gamma}$ and $F(z) = \mu - \nu \cdot z^s$, where α, β, χ, γ, μ, ν, p, r and s are selected non-negative values.

*37 (new). The method of claim 35, further comprising programming said metric d(x(q);y;q) to depend upon said vectors x(q) and y and depends upon said index q only through said vector x(q).

*38 (new). The method of claim 35, wherein, for at least two distinct values q' and q", with corresponding vectors x(q') in said set S1 and x(q") in said set S2, further comprising programming said metric value d(x(q');y;q') to differ from said metric value d(x(q");y;q") for at least one measurement vector y.

*39 (new). The method of claim 35, further comprising programming each of said functions F(d(x(q);y;q)) to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and further comprising programming said computer to interpret said value F(d(x'(q);y;q)) for at least one vector x'(q) in said set S1 as a probability that said measurement vector y belongs to said set S1.

*40 (new). The method of claim 35, further comprising programming each of said functions F(d(x(q);y;q)) to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and further comprising programming said computer to interpret said value F(d(x'(q);y;q)) for at least one vector x'(q) in said set S2 as a probability that said measurement vector y belongs to said set S2.

*41 (new). The method of claim 35, further comprising programming said computer so that at least one of said sets S1 and S2 corresponds to at least one of a normal medical condition and a benign medical condition.

*42 (new). The method of claim 35, further comprising programming said computer so that at least one of said sets S1 and S2 corresponds to a malignant medical condition.

CLEAN VERSION OF CLAIMS, AS AMENDED

1. A system for performing one or more relevant measurements at a target site in an animal body, the system comprising:

a probe that can be inserted into a body adjacent to or within a target site and that comprises at least two of:

a first sensor that measures one or more elastic parameters associated with the target site drawn from a group consisting of a Young's modulus, a bulk modulus and a Poisson's ratio associated with the target site;

a second sensor that measures one or more thermal parameters, drawn from a group consisting of local temperature, thermal conductivity and specific heat capacity associated with the target site;

a third sensor that measures optical reflectance $OR(\lambda;meas)$ of a selected region of the target site for one or more selected wavelength ranges;

a fourth sensor that measures a selected characteristic of a margin of the target site;

an fifth sensor that measures amount of blood flow adjacent to or within the target site;

a sixth sensor that measures interstitial fluid pressure adjacent to or within the target site;

a seventh sensor that measures vascular size and/or vascular density associated with the target site;

an eighth sensor that measures oxygen tension pO2 associated with the target site;

a ninth sensor that measures local pH associated with a selected portion of the target site; and

a tenth sensor that measures at least one of an electrical parameter associated with a selected portion of the target site.

2. The system of claim 1, wherein at least one of said two sensor measurements is combined with at least one additional measurement that is drawn from a group of measurements, performed adjacent to or within said target site, consisting of lymph node samples, mammograms, ultrasound scans, NMRI scans, CAT scans, estimation of target site size, estimation of target site shape, estimation of target site surface roughness and estimation of calcification pattern.

3. The system of claim 1, wherein at least one of said two sensor measurements is combined with at least one additional information item that is drawn from a group consisting of (1) at least one medical condition that said animal has exhibited and (2) at least one medical condition that a family member of said animal has exhibited.

4. The system of claim 19, wherein, when at least one of said sensors provides a measurement value that does not fall within said corresponding range of values for said normal target site, said database and analyzer provides at least one disease or malady of said target site that is consistent with each of said sensor measurement.

5. The system of claim19, wherein said analyzer comprises a neural net device that receives and processes said measurement from said at least two sensors and

provides at least one processed measurement value that can be compared with said corresponding range of values for said normal target site.

6. The system of claim 5, wherein said neural net device performs a radial basis neural network analysis.

7. The system of claim 5, wherein said neural net device performs a backpropagation neural network analysis.

8. The system of claim 1, wherein at least one of said two sensors is used to navigate said probe to a location adjacent to or within said target site.

9. A method for performing one or more relevant measurements at a target site in an animal body, the method comprising:

providing a probe that can be inserted into a body adjacent to or within a target site and that comprises at least two of:

a first sensor that measures one or more elastic parameters associated with the target site drawn from a group consisting of a Young's modulus, a bulk modulus and a Poisson's ratio associated with the target site;

a second sensor that measures one or more thermal parameters, drawn from a group consisting of local temperature, thermal conductivity and specific heat capacity associated with the target site;

a third sensor that measures optical reflectance $OR(\lambda;meas)$ of a selected region of the target site for one or more selected wavelength ranges;

a fourth sensor that measures a selected characteristic of a margin of the target site;

an fifth sensor that measures amount of blood flow adjacent to or within the target site;

a sixth sensor that measures interstitial fluid pressure adjacent to or within the target site;

a seventh sensor that measures vascular size and/or vascular density associated with the target site;

an eighth sensor that measures oxygen tension pO2 associated with the target site;

a ninth sensor that measures local pH associated with a selected portion of the target site; and

a tenth sensor that measures at least one of an electrical parameter associated with a selected portion of the target site.

10. The method of claim 9, further comprising combining said at least one of said two sensor measurements with at least one additional measurement, performed adjacent to or within said target site, consisting of lymph node samples, mammograms, ultrasound scans, NMRI scans, CAT scans, estimation of target site size, estimation of target site shape, estimation of target site surface roughness and estimation of calcification pattern.

11. The method of claim 9, further comprising combining at least one of said two sensor measurements with at least one additional information item that is drawn from a group consisting of (1) at least one medical condition that said animal has exhibited and (2) at least one medical condition that a family member of said animal has exhibited.

12. The method of claim 18, further comprising:

when each of at least one of said sensors provides a measurement value that does not fall within said corresponding range of values for said normal target site, said computer is programmed to provide at least one disease or malady of said target site that is consistent with each of the at least two sensor measurement.

13. The method of claim 18, further comprising providing said analyzer with a neural net device that receives and processes said measurement from said at least one sensor and provides a processed measurement value that can be compared with said corresponding range of values for said normal target site.

14. The method of claim 13, further comprising choosing said neural net device to perform a radial basis neural network analysis.

15. The method of claim 13, further comprising choosing said neural net device to perform a backpropagation neural network analysis.

16. The method of claim 9, further comprising using at least one of said sensors to navigate said probe to a location adjacent to or within said target site.

17. The system of claim 1, wherein at least one of said at least two sensors is said third sensor that measures said optical reflectance, using at least one optical fiber that transports an image of a selected portion of said selected region of said target site.

18. The method of claim 9, further comprising providing, as at least one of said at least two sensors, said third sensor and measuring said optical reflectance by using at least one optical fiber that transports an image of a selected portion of said selected region of said target site.

19. The system of claim 1, further comprising a database and analyzer that receives and compares each of said measurements made by said probe with a corresponding range of values that is representative of a normal target site and, for each of said sensor measurements that does not fall within the corresponding range of values for a normal target site, the database and analyzer provides at least one

medical condition of said target site that is generally consistent with said sensor measurement.

20. The method of claim 9, further comprising providing a database and analyzer, including a computer that is programmed to receive and compare each of said measurements made by said probe with a corresponding range of values that is representative of a normal target site and, for each of said probe measurements that does not fall within the corresponding range of values for a normal target site, the database and analyzer provides at least one disease or malady of the target site that is consistent with said probe measurement.

21. A system for estimating a medical condition associated with a target site in an animal body, the system comprising:

a first database that contains R-dimensional vector values $\mathbf{x}(q)$ of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value $\mathbf{x}(q)$ in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

a second database that contains vector values $\mathbf{y}$ in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where $\mathbf{y}$ is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

a computer that is programmed to form a non-negative, real-valued medical condition function of a metric distance between the vector $\mathbf{x}(q)$ and the vector $\mathbf{y}$, where the medical condition function distinguishes between a first medical condition in which $\mathbf{y}$ is more likely associated with the first set S1 and a second medical condition in which $\mathbf{y}$ is more likely associated with the second set S2.

22. The system of claim 21, wherein at least one of said sets S1 and S2 corresponds to at least one of a normal medical condition and a benign medical condition.

23. The system of claim 21, wherein at least one of said sets S1 and S2 corresponds to a malignant medical condition.

24. A system for estimating a medical condition associated with a target site in an animal body, the system comprising:

a first database that contains R-dimensional vector values $\mathbf{x}(q)$ of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value $\mathbf{x}(q)$ in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

a second database that contains vector values y in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where y is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

a computer that is programmed:

to form a non-negative, real-valued metric $d(\mathbf{x}(q);\mathbf{y};q)$, depending upon vectors $\mathbf{x}(q)$ and y drawn from the first and second databases, respectively, and upon the index q;

to form a medical condition function $F(d(\mathbf{x}(q);\mathbf{y};q))$, depending upon the metric values $d(\mathbf{x}(q);\mathbf{y};q)$, where F is a selected non-negative, monotonically decreasing function of the metric value $d(\mathbf{x}(q);\mathbf{y};q)$;

to compute the quantities $F1(\mathbf{y}) = \max_{\mathbf{w}(q) \text{ in } S1} F(d(\mathbf{w}(q);\mathbf{y};q))$ and $F2(\mathbf{y}) = \max_{\mathbf{w}(q) \text{ in } S2} F(d(\mathbf{w}(q);\mathbf{y};q))$;

when $F1(\mathbf{y}) > F2(\mathbf{y})$, to interpret the value $F1(\mathbf{y})/\{F1(\mathbf{y})+F2(\mathbf{y})\}$ as a lower bound on a probability that the measurement value y is associated with the

first set S1, and to interpret the value F2(y)/{F1(y)+F2(y)} as an upper bound on a probability that the measurement value y is associated with the first set S2; and

when F1(y) < F2(y), to interpret the value F1(y)/{F1(y)+F2(y)} as an upper bound on a probability that the measurement value y is associated with the first set S1, and to interpret the value F2(y)/{F1(y)+F2(y)} as a lower bound on a probability that the measurement value y is associated with the first set S2.

25. The system of claim 24, wherein said computer is further programmed to draw said function F(z) for a non-negative value z from a group of functions consisting of $F(z) = \exp\{-\alpha \cdot z^p\}$, $F(z) = \{\beta + \chi \cdot z^r\}^{-\gamma}$ and $F(z) = \mu - \nu \cdot z^s$, where α, β, χ, γ, μ, ν, p, r and s are selected non-negative values.

26. The system of claim 24, wherein said metric d(x(q);y;q) depends upon said vectors x(q) and y and depends upon said index q only through said vector x(q).

27. The system of claim 24, wherein, for at least two distinct values q' and q" with corresponding vectors x(q') in said set S1 and x(q") in said set S2, said metric value d(x(q');y;q') differs from said metric value d(x(q");y;q") for at least one measurement vector y.

28. The system of claim 24, wherein each of said functions F(d(x(q);y;q)) is chosen to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and said computer is further programmed to interpret said value F(d(x'(q);y;q)) for at least one vector x'(q) in said set S1 as a probability that said measurement vector y belongs to said set S1.

29. The system of claim 24, wherein each of said functions F(d(x(q);y;q)) is chosen to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and said computer is further programmed to interpret said value F(d(x'(q);y;q)) for at least

one vector x'(q) in said set S2 as a probability that said measurement vector y belongs to said set S2.

30. The system of claim 24, wherein at least one of said sets S1 and S2 corresponds to at least one of a normal medical condition and a benign medical condition.

31. The system of claim 24, wherein said at least one of said sets S1 and S2 corresponds to a malignant medical condition.

32. A method for estimating a medical condition associated with a target site in an animal body, the method comprising:

providing a first database that contains R-dimensional vector values x(q) of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value x(q) in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

providing a second database that contains vector values y in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where y is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

programming a computer to form a non-negative, real-valued medical condition function of a metric distance between the vector x(q) and the vector y, where the medical condition function distinguishes between a first medical condition in which y is more likely in the first set S1 and a second medical condition in which y is more likely in the second set S2.

33. The method of claim 32, further comprising choosing said at least one of said sets S1 and S2 to correspond to at least one of a normal medical condition and a benign medical condition.

34. The method of claim 32, further comprising choosing at least one of said sets S1 and S2 to correspond to a malignant medical condition.

35. A method for estimating a medical condition associated with a target site in an animal body, the method comprising:

providing a first database that contains R-dimensional vector values $\mathbf{x}(q)$ of reference values of measurements, with q in Q1 or q in Q2, where Q1 and Q2 are mutually exclusive index sets, where each vector value $\mathbf{x}(q)$ in the first database is associated with a first set S1 of medical conditions, corresponding to q being a member of Q1, or with a second set S2 of medical conditions, corresponding to q being a member of Q2, where S1 and S2 are mutually exclusive and R is a selected positive integer;

providing a second database that contains vector values $\mathbf{y}$ in a set S3 of one or more measurements made at or adjacent to a selected target site in a body of a selected animal, where $\mathbf{y}$ is a P-dimensional vector and P is a selected positive integer with $P \leq R$; and

programming a computer:

to form a non-negative, real-valued metric $d(\mathbf{x}(q);\mathbf{y};q)$, depending upon vectors $\mathbf{x}(q)$ and $\mathbf{y}$ drawn from the first and second databases, respectively, and upon the index q;

to form a medical condition function $F(d(\mathbf{x}(q);\mathbf{y};q))$, depending upon the metric values $d(\mathbf{x}(q);\mathbf{y};q)$, where F is a selected non-negative, monotonically decreasing function of the metric value $d(\mathbf{x}(q);\mathbf{y};q)$;

to compute the quantities $F1(\mathbf{y}) = \max_{\mathbf{w}(q) \text{ in } S1} F(d(\mathbf{w}(q);\mathbf{y};q))$ and $F2(\mathbf{y}) = \max_{\mathbf{w}(q) \text{ in } S2} F(d(\mathbf{w}(q);\mathbf{y};q))$;

when F1(y) > F2(y), to interpret the value F1(y)/{F1(y)+F2(y)} as a lower bound on a probability that the measurement value y is associated with the first set S1, and to interpret the value F2(y)/{F1(y)+F2(y)} as an upper bound on a probability that the measurement value y is associated with the first set S2; and

when F1(y) < F2(y), to interpret the value F1(y)/{F1(y)+F2(y)} as an upper bound on a probability that the measurement value y is associated with the first set S1, and to interpret the value F2(y)/{F1(y)+F2(y)} as a lower bound on a probability that the measurement value y is associated with the first set S2.

36. The method of claim 35, further comprising programming said computer to draw said function F(z) for $z \geq 0$ from a group of functions consisting of $F(z) = \exp\{-\alpha \cdot z^p\}$, $F(z) = \{\beta + \chi \cdot z^r\}^{-\gamma}$ and $F(z) = \mu - \nu \cdot z^s$, where α, β, χ, γ, μ, ν, p, r and s are selected non-negative values.

37. The method of claim 35, further comprising programming said metric d(x(q);y;q) to depend upon said vectors x(q) and y and depends upon said index q only through said vector x(q).

38. The method of claim 35, wherein, for at least two distinct values q' and q", with corresponding vectors x(q') in said set S1 and x(q") in said set S2, further comprising programming said metric value d(x(q');y;q') to differ from said metric value d(x(q");y;q") for at least one measurement vector y.

39. The method of claim 35, further comprising programming each of said functions F(d(x(q);y;q)) to satisfy $0 \leq \max_{y \text{ in } S3} F(d(x(q);y;q)) \leq 1$ for each vector x(q) and further comprising programming said computer to interpret said value F(d(x'(q);y;q)) for at least one vector x'(q) in said set S1 as a probability that said measurement vector y belongs to said set S1.